12. Landscape Scale Strategy for Restoring the Longleaf Pine Ecosystem on the Osceola National Forest

1. Executive Summary

The Ecological Condition Model (ECM) described in this document forms the analytical basis for developing the Collaborative Forest Landscape Restoration (CFLR) strategy. Specific treatments, acreages, and costs of this proposal are identified in the CFLR strategy spreadsheet available at: ftp://ftp2.fs.fed.us/incoming/r8/Florida/CFLR/ CFLR Funding Plan FY10_FY19_FINAL.xlsx

In order to dramatically increase the health of the longleaf pine (LLP) ecosystems within the Osceola National Forest (ONF), a Landscape Scale Assessment (LSA) was conducted in 2009 (available at: ftp://ftp2.fs.fed.us/incoming/r8/Florida/CFLR/ONF_LSA.pdf). As a part of this LSA a spatial ECM was developed to assess current ecological condition vs. desired future condition (DFC) using ranked tiers. This analysis revealed that 48% of these ecosystems are in poor or very poor condition and 40% are in fair condition which could transition to poor condition if not treated. With this important baseline information spatial prioritization models were developed to prioritize prescribed fire, timber and mechanical fuels treatments for the next 10 years. The models will be updated annually to reflect changes in ecological condition based on prior treatments and, with help from interdisciplinary cooperators/stakeholders, updated for the next fiscal year.

This combined modeling approach enables our forest to: 1) maximize integration of program areas and funding, 2) balance restoration activities with maintenance of areas in good to excellent condition, 3) connect high quality areas to form larger contiguous blocks, 4) strategically plan management actions to maximize restoration effectiveness, and 5) provide feedback for adaptive management.

Funding from the CFLR Program would allow for accelerated restoration of LLP on the ONF and shift a significant portion of the landscape (Figures 1, 3, and 4 and Table 1) from needing restoration to only needing maintenance (i.e., maintained through frequent prescribed fire). Without the CFLR funding the restoration of LLP would be limited to a small portion of the landscape on the southwest corner of the ONF (Figures 1, 2 and 4, Table 1). To estimate 2019 ecological conditions an assumption was made that more than one restoration treatment (e.g., silvicultural treatment and prescribed fire) would be required to improve the Tier scores. Using the strategic planning tools described in this document, the ONF will increase the number of acres in good and excellent condition (Figure 2), however with CFLR funding the LLP restoration will be greatly accelerated and expanded over a significantly larger area (Figure 3).
Figure 1. Current conditions on the Osceola National Forest from the 2009 Ecological Condition Model. Tier 1 and 2 represent excellent to good condition, Tier 3 represents transitional condition and Tier 4 and Tier 5 represent poor to very poor condition.
Figure 2. ECM estimated 2019 conditions on the ONF with no CFLR funding (only appropriated funds).
Figure 3. ECM estimated 2019 conditions on the ONF with CFLR funding.
Table 1. Acres of pine flatwoods in respective ECM tier classes for current conditions (ECM 2009), 2019 with no CFLR funding and 2019 with CFLR funding

<table>
<thead>
<tr>
<th>Tier</th>
<th>ECM 2009</th>
<th>ECM 2019 no CFLRP Funding</th>
<th>ECM 2019 with CFLRP Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>314</td>
<td>443</td>
</tr>
<tr>
<td>2</td>
<td>14,145</td>
<td>27,406</td>
<td>48,871</td>
</tr>
<tr>
<td>3</td>
<td>44,870</td>
<td>39,161</td>
<td>33,285</td>
</tr>
<tr>
<td>4</td>
<td>28,762</td>
<td>25,089</td>
<td>17,714</td>
</tr>
<tr>
<td>5</td>
<td>24,046</td>
<td>19,856</td>
<td>11,515</td>
</tr>
</tbody>
</table>

Figure 4. Acres of pine flatwoods in respective ECM tier classes for current conditions (light gray), 2019 with no CFLR funding (dark grey) and 2019 with CFLR funding (black).
2. Existing Conditions from the Ecological Condition Model

A spatial ECM was developed to quantify the current ecological condition of the flatwood ecosystems on the ONF, to assist in project planning, and to assist in prioritizing management and restoration needs and actions (for more details see the 2009 ONF Landscape Scale Assessment at: ftp://ftp2.fs.fed.us/incoming/r8/Florida/CFLR/ONF_LSA.pdf). The model classifies the flatwoods into tier classes based on relative deviation from desired future condition (see Desired Future Conditions below). The model is intended for use as a mid-level planning tool, and not necessarily to direct what actions should be taken at the level of individual stands. Factors that were used to estimate current (2009) ecological condition include fire effects, basal area, and stand age.

Fire effects were selected as an input because it is one of the single-most important forces needed to maintain or restore flatwoods. Frequent (every 2-3 years) prescribed fires of at least moderate severity are needed to increase coverage of grassy groundcover, to limit or reduce cover of saw palmetto and shrubs, and is essential for natural regeneration of pines, especially LLP. Although a method to rapidly and directly assess herbaceous groundcover condition across the forest’s flatwoods is not available, it is assumed here that fire history largely determines groundcover health. Fire history and severity were estimated from a time series of satellite imagery (1998-2008) using techniques developed for ecosystems of Northern Florida through a recent Joint Fire Science Program grant (Robertson et al. 2009). The model inputs included fire severity, number of fires (1998-2008) and time since last fire. These three fire components were combined in a weighted sum to derive an overall fire tier score.

Basal area was used as an input to the ECM because it is a primary means to measure desired characteristics of pine canopy (e.g., too many trees shade native pyrogenic groundcover, too few trees decreases abundance of desirable wildlife species and eventually leads to loss of forest structure). Basal area classes were estimated using data from approximately 100 field plots collected from 2006-2008 and Tasseled Landsat satellite imagery from 2008 (Healey et al. 2005). The accuracy of this basal area product was evaluated using a separate validation set of field plots and was found to be over 70% at the pixel level (i.e., 30 m). The basal area estimates were converted to a basal area tier score based on information from the USFWS red-cockaded woodpecker (RCW) Recovery Plan (USFWS 2005). For example the highest tier score (Tier 1) was assigned to areas with basal areas values between 40-60 ft² per acre, which is the optimal basal area value according to the RCW Recovery Plan.

Stand age was also selected as an ECM input because stands with older age classes are necessary for meeting a wide array of forest goals and objectives (e.g., providing habitat for
red-cockaded woodpecker). Stand ages were derived directly from the forest GIS data library using USFS old-growth guidelines for the Southern Region (USFS, 1997) and were converted to a tier score based on the USFWS RCW Recovery Plan (old-growth and stands capable of supporting RCWs are weighted higher).

The individual tier scores from fire, basal area and stand age were then combined using a weighted sum approach to derive an overall tier score (from 1 to 4). Tier 5 scores were assigned to dense slash pine plantations that were hydrologically disturbed during site preparation.

Once the model parameters were established, the model was used to identify areas with a high priority for vegetation management activities (Hiers et al. 2003). More information about this modeling process can be found in section 3 of this document.

**Desired Future Conditions of Flatwoods**

The desired future conditions of flatwoods are described in the Forest Land and Resource Management Plan as follows: Overstory is dominated by longleaf pine or mixed longleaf and slash pine that has an appropriate distribution of stand ages, tree sizes, and tree densities, with the oldest age class of greater than 110 years of age, and average pine basal area (BA) of 40-60 ft² per acre. Except on relatively small drier sandhill ridges and some wetland ecotones, there is no hardwood midstory. Species-rich groundcover is distributed continuously across the landscape and is dominated by native grasses and forbs, and saw palmetto cover is less than ~30%. The vegetation patterns are maintained by frequent prescribed burning and large, uncharacteristically severe wildfires do not occur.

**ECM Tier Classification**

Model outputs are classified into 5 tier levels based on deviation from DFCs.

*Tiers 1 and 2* represent areas in excellent to good ecological condition that are essentially in a *maintenance level* of management. These areas are very close to an undisturbed and fully functioning ecological condition that has been maintained by frequent fire and do not currently need timber thinning or planting to achieve current basal area objectives. The stand age is either old growth (> 110 years old, Tier 1) or near old growth (89-109 years old, Tier 2). Groundcover in these areas is dominated by native herbaceous species (e.g., wiregrass, dropseed) and saw palmetto/shrubs are not overwhelmingly dominant in cover or stature. Additionally these areas have no apparent hydrological disturbance.
Tier 3 represents areas in a transitional state (fair condition) that require some restoration efforts. This includes mature (60-89 years old) natural stands of longleaf, slash and mixed longleaf/slash pine typically with moderate to high basal area (60-80 ft² per acre). These areas typically have some deviation from the natural fire regime (e.g., 3-5 year fire return intervals and no moderate to high severity fires in recent history) and as such have experienced a shift in groundcover from native herbaceous species (e.g., wiregrass, dropseed) to more saw palmetto/shrubs (though a good representation of native herbaceous species is still present). Tier 3 may also include areas that have experienced multiple, intense wildfires which have killed much or all of the pine canopy but still retain a
representation of native plant (wiregrass, dropseed) and animal (Bachman's sparrow) species typical of undisturbed condition. Restoration of these areas may involve planting longleaf trees to increase basal area over time. Tier 3 areas have minimal to no hydrological disturbance.

Management objectives should be selected to ensure that stands shift into Tier 2, based on prioritization of stands through the spatial prioritization models (see section 3 below). Restoration treatments may include increasing prescribed fire frequency (and/or targeting more intense application of prescribed fire), timber thinnings, and/or mechanical treatments such as roller chopping. If not actively managed, Tier 3 stands can rapidly degrade to Tier 4.

Figure 7. Example of Tier 3 mesic flatwoods

**Tier 4** represents areas in poor ecological condition which will require substantial restoration efforts. This includes natural stands of slash and mixed slash/longleaf with high levels of disturbance (including fire exclusion) that no longer contain representative native herbaceous species of a typical undisturbed state. These stands are typically younger (≤ 60 years old) and have high to very basal areas (> 80 ft²). Additionally, Tier 4 areas have minimal to no hydrological disturbance.

Restoration required to reduce tier level will typically involve multiple treatment types, for example timber harvesting and mechanical treatments followed by increased prescribed fire frequency. Large-scale efforts may be needed to seed/plant herbaceous groundcover to restore pre-disturbance species composition and abundance.
Tier 5 represents areas in very poor ecological condition that will require substantial restoration efforts. These areas are typically young (≤ 60 years old) very high basal area (> 80 ft²) plantations of longleaf, slash and, mixed slash/longleaf with very high levels of disturbance (including hydrological disturbance caused by site preparation such as bedding and ditching). These areas no longer contain a good representation of species typical of an undisturbed state. Restoration required to reduce tier level includes timber thinning, mechanical treatment (for fuel reduction), herbicide treatment, and/or native groundcover seeding/planting as well as hydrological restoration.

Figure 8. Example of Tier 4 wet flatwoods

Figure 9. Example of Tier 5 bedded and ditched plantation
Figure 10. Map of 2009 ECM results. ECM can be updated annually to reflect the changes in condition due to management activities.

Table 2. Acreages and % of landscape in different ecological Tiers for 2009 ECM.

<table>
<thead>
<tr>
<th>Tier Class</th>
<th>Ecological Condition</th>
<th>Acres</th>
<th>Percent of Flatwoods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excellent</td>
<td>3</td>
<td>0.003%</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>14,145</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Transitional</td>
<td>44,870</td>
<td>40%</td>
</tr>
<tr>
<td>4</td>
<td>Poor</td>
<td>28,761</td>
<td>26%</td>
</tr>
<tr>
<td>5</td>
<td>Very Poor</td>
<td>24,046</td>
<td>22%</td>
</tr>
</tbody>
</table>
The flatwoods within what is now the ONF, were originally dominated by LLP and were cut-over before the ONF was established in 1931. None of the primary old-growth stands of the original forest remain. Stands greater than 80 years old are currently rare and stands >100 years old are exceedingly rare. Most of the cut-over land was replanted or regenerated to slash pine stands under USFS management.

The following describes the results of the 2009 ECM by Tier class.

Tiers 1 and 2
Only 0.003% of the flatwoods is currently known to support pines > 110 years old, and could be classified as Tier 1. Approximately 13% of the flatwoods is currently in good/maintenance condition. If management of these lands continues as it has, they could gradually shift to tier 1 as stands continue develop older age classes. It is also possible that their condition could decline if management action is not sufficient (e.g. insufficient frequency of fires with sufficient severity to control saw palmetto and woody shrubs).

Tier 3
The model indicates that ~40% of the flatwoods is in transitional condition, meaning that restoration can be achieved by increased management action. These lands consist of areas that have not burned with frequent fires of sufficient severity to adequately control growth of saw palmetto and woody shrubs and/or have undesirably high or low average pine basal areas. A shift from tier 3 to tier 2 may be achieved in some cases by thinning to desired basal areas. In others, increasing frequency of fires with sufficient severity may be enough for a shift from tier 3 into tier 2. However, additional measures such as mechanical treatment of saw palmetto and hardwoods (e.g., single, light pass with roller-chopper) will likely be necessary to achieve restoration objectives. Tier 3 also includes lands that have suffered from high-severity wildfires that reduced pine canopy to undesirable levels. Reestablishment of a mature pine canopy (preferably LLP in the majority of areas) and frequent fires of sufficient severity will be required for a shift to tier 2.

Tier 4
Approximately one-quarter (26%) of the non-plantation flatwoods are estimated by the model to be in poor ecological condition due to undesirably high average pine basal areas, insufficient stand age, low fire severity scores, overly long fire return intervals, and/or long times since fire. Much of these lands will require substantial restoration efforts to return them to tier 3 conditions or better.
Tier 5
Over a fifth (22%) of the flatwoods was converted to pine plantation in past decades. Conversion was accompanied by heavy groundcover disturbance (near elimination in many stands), soil bedding, and ditching. In some cases, thinning of stands and application of fire may be sufficient to cause shift to tier 4, but progress over many areas will require substantial investment in efforts to restore topography, local hydrology, and the original groundcover diversity.

The accuracy of the ECM model results were evaluated using data from 48 field plots collected in May and June of 2009 across a range of different ecological conditions. Within each field plot, photo points were collected and the condition of the ground cover was assessed. Ground-truthing revealed that the models accuracy was 81% (39 out of 48 plots were placed in the same tier class as defined in the field). The other 9 plots were no more than one tier class away from the value assigned in the field (see the 2009 ONF Landscape Scale Assessment for more details available at: ftp://ftp2.fs.fed.us/incoming/r8/Florida/CFLR/ONF_LSA.pdf)

3. Prioritizing Treatments using Spatial Prioritization Models

The ECM results are used to provide baseline ecological conditions that are critical to prioritizing management treatments for the next fiscal year. The ECM results are combined with other resource data layers (e.g., RCW foraging areas) to prioritize areas of the forest for treatment and discussed as part of an annual interdisciplinary collaborative planning meeting.

The ONF’s interdisciplinary (ID) team developed the prioritization models by: 1) selecting resource factors (model inputs) believed to contribute most to sound decisions on prioritizing various treatments and assigning relative influence values to them, and 2) assigning relative importance weights to different values within each input. For example, to develop the 2009 Timber Prioritization Model (TPM) for the ONF the ID team chose resource factors such as RCW foraging areas and basal area as model inputs with high relative influence values and areas within the wildland urban interface (WUI) as a model input with a lower relative influence value. For the next step the ID Team assigned relative weights for each of those inputs, for example, weighting areas that have a basal area > 80 ft$^2$ per acre higher than an area with a basal area of 60-80 ft$^2$ per acre. Areas with more overlapping resource factors, and/or with resource factors that are weighted higher will be ranked higher in the output from the prioritization model.

The model prioritization process is flexible in terms of inputs and weights assigned, and can change from year to year. This captures and utilizes the knowledge of forest staff and key
stakeholders to derive the number and types of models needed to balance the ONF’s competing resource needs. Priorities will necessarily change over time as areas of the forest improve or degrade in ecological condition (i.e., shift tiers) and as land management actions are taken.

In September 2009, Forest and District staff met with key stakeholders to develop three separate prioritization models for the 2010 fiscal year. These models are described in more detail below.

**Prescribed Fire Prioritization Model**

The 2009 ID team chose to develop a Fire Prioritization Model that would allow them to run two separate scenarios. The first scenario was targeted for areas in a maintenance level of management and used the following inputs in order of relative importance: time since last fire (particularly 2-4 yrs), proximity to ECM tier 2 areas, RCW forage partitions, WUI areas and ECM tier score (Figure 11).

The second scenario for the Fire Prioritization Model was targeted for areas with heavy fuels and RCW habitat. The following inputs were used in this scenario: time since last fire (particularly >5 yrs), RCW forage partitions, ECM tier score (particularly tiers 3 and 4), number of burns between 1998-2008 (particularly areas with 0 or 1 burn), and WUI areas (Figure 12).

The outputs for both scenarios of the 2009 Fire Prioritization model are shown below (Figures 11 and 12). The color scale is from blue (areas with very low priority) to orange and red (areas with very high priority) and dark grey values represent areas that are not pine flatwoods.

The fire prioritization model will be updated annually as part of interdisciplinary collaborative planning meeting. This process will first involve updating the current ecological conditions (i.e., updating the ECM based on the previous year’s activities) and then identifying new prioritization model inputs that may be necessary. For example areas that were recently thinned or roller chopped and need a follow-on prescribed fire within the next year will be weighted very high in the model.
Figure 11. 2009 Fire Prioritization Model Scenario 1: Maintenance Emphasis. The color scale is from blue (areas with very low priority) to orange and red (areas with very high priority) and dark grey values represent areas that are not pine flatwoods.
Figure 12. 2009 Fire Prioritization Model Scenario 2: Heavy fuels and RCW Emphasis. The color scale is from blue (areas with very low priority) to orange and red (areas with very high priority) and dark grey values represent areas that are not pine flatwoods.
Mechanical Fuels Treatment Model

A separate Mechanical Fuels Model was developed by the ID team to target emphasizing areas along major highways with no fire within the past 7 years. This model also use basal area to constrain treatments to areas with operable basal area (<60 ft²/acre). The results are shown below using the same color scale (orange and reds = high priority). High priority areas were treated using funds from the American Recovery and Reinvestment Act (ARRA) in FY10 see Other Restoration Activities section below.

Figure 13. 2009 Mechanical Fuels Prioritization Model. The color scale is from blue (areas with very low priority) to orange and red (areas with very high priority).
Timber Prioritization Model

The 2009 ID team developed a timber prioritization model (TPM) to identify areas where timber thinning treatments could make the greatest impact to improve ecosystem health. The inputs chosen to initialize this model were (in order of relative importance): RCW foraging areas, basal area (particularly > 60 ft² per acre), stand age (20-80 year old stands), forest type (preference to thin slash from longleaf dominated stands), ECM tier score, proximity to tier 2 (high quality) areas, and WUI areas. The 2009 TPM results are shown below (Figure 14).

The TPM results were initially used to identify the highest priority areas to treat within the next 3-5 years as part of the ONF’s 5 year Vegetation Management Plan. Using the 2009 timber prioritization model this analysis has been extended to also include areas which could be treated from 2010-2019 with additional funding from the Collaborative Forest Landscape Restoration Program. A total area of approximately 45,000 acres would be thinned within this 10 year period and these areas are shown in Figure 15 below.

Although the 2009 TPM was used to estimate the areas that would be treated from 2010-2019, the actual areas chosen for treatment may vary. The TPM will be updated annually as part of interdisciplinary collaborative planning meetings. This process will first involve updating the current ecological conditions (i.e., updating the ECM based on the previous year’s activities) and then identifying new prioritization model inputs that may be necessary (e.g., areas where artificial RCW recruitment cavities are located in future years).
Figure 14. 2009 Timber Prioritization Model. The color scale is from blue (areas with very low priority) to orange and red (areas with very high priority) and dark grey values represent areas that are not pine flatwoods.
Figure 15. 2010-2019 Planned Timber Sales based on 2009 Timber Prioritization Model results
**Ground cover restoration**

Saw palmetto has become a dominant shrub species in many pine flatwoods of the southeastern Coastal Plain. Due to shrub invasion, especially by saw palmetto, large portions of pine flatwoods habitats are in poor condition and currently exist in a highly degraded state as illustrated by the 2009 ECM results.

Over large areas of the ONF pine flatwoods, repeated application of low intensity fire will not be sufficient to reduce saw palmetto height, cover, and density where it has proliferated over the past decades during which a preponderance of prescribed fires have been low severity. Long-term high frequency (e.g., annual) dormant season burning can maintain high quality groundcover in mesic flatwoods, but early summer burns (while maintaining a high frequency) may be necessary to increase cover of herbaceous groundcover - bunchgrasses in particular (Glitzenstein *et al.*, 2003).

Because it is not feasible to either burn a majority of the ONF pine flatwoods at frequencies and/or severities needed for groundcover restoration, additional treatments such as roller drum chopping in combination with prescribed burning (dormant or growing season) are needed to rapidly and significantly reduce palmetto height (Figure 16), cover, and density in pine flatwoods (Wilcox and Giuliano, 2010).

The ECM identified at least 21,000 acres where light roller drum chopping could have the greatest influence on restoring native ground cover. To avoid potential damage in wet flatwoods, the ECM identified mesic flatwood areas with no moderate to high severity fire within the past 10 years and these areas were overlaid with planned timber sales from 2010-2019 to identify potential roller chopping areas.

Areas located within the Federally Threatened frosted flatwoods salamander (FFS) conservation area on the southeast portion of the ONF already have a favorable basal area to allow light roller drum chopping. These areas were combined with the fire history data focused on areas with no moderate to high severity fire in the past 10 years. The potential
roller drum chopping areas totaled approximately 2,500 acres and their locations are illustrated in Figure 17.

**Figure 16.** Results of light roller drum chopping to restore ground cover on Three Lakes Wildlife Management Area in south-central Florida.
Figure 17. Potential Roller Drum Chopping Areas for ground cover restoration 2010-2019.
Other Restoration Activities

In addition to the activities discussed above, additional restoration activities to restore LLP ecosystems on the ONF include mowing in high fuels areas (based on the Mechanical Fuels Reduction model), LLP reforestation on approximately 7,200 acres affected by the 2007 Bugaboo fire area and removal of approximately 90 miles of old grazing allotment fencing to facilitate the creation of larger prescribed fire areas. The proposed locations of these activities are shown in Figure 18. For a detailed list of activities by year see: ftp://ftp2.fs.fed.us/incoming/r8/Florida/CFLR/CFLR Funding Plan FY10_FY19_FINAL.xlsx

Figure 18. Proposed locations for mowing within high fuels areas (see Figure 13 for details on Mechanical Fuels Prioritization Model), longleaf reforestation and fence removal.
4. Monitoring the Effectiveness of Management Activities

Due to the size and scope of this CFLR project, the number of acres treated, the variety and order of restoration activities, the multiparty monitoring requirements and the strong potential for technology transfer to all landowners of pine flatwoods in the southeast coastal plain, the ONF is pursuing a comprehensive monitoring strategy to include Tall Timbers Research Station and Land Conservancy (TTRSLC). A Challenge Cost-Share agreement will be developed to match TTRSLC’s $620,000 In-Kind contribution with CFLR’s $744,000 for monitoring LLP restoration activities for up to 15 years.

Vegetation and Avian Community Response to Management Activities

To examine the effectiveness of proposed management activities (timber thinning, light roller drum chopping, variations in temporal and spatial scale of prescribed fire, etc.) on both vegetation and related avian communities, the TTRSLC’s Uplands Ecosystem Restoration Project team will establish and annually revisit approximately 40 monitoring plots (approximately 200 acres each) within the CFLR Primary Enhancement Areas (i.e., areas where most timber and groundcover restoration management activities will be located). Potential monitoring plot locations are shown in Figure 18.

The 40 monitoring plots will be randomly placed in CLFR Primary Enhancement Areas to attain a sampling intensity of 15-20% of these areas. These plots will serve as the basic sampling unit and link vegetation and photo point data to resident and migratory bird monitoring data. Relatively intensive sampling within each plot will provide data to assess density of avian species and will allow for the correlation to vegetation and management actions within and across plots, thus influencing future management actions on the ONF.

Multiple-observer strip-transect flush-counts will be used in areas with low density timber density. Preliminary sampling will occur in 2010 to estimate sampling intensity. Initially, TTRSLC anticipates using 8, 100 m transects per sampling area. Within each plot, 10 fixed-radius point counts will be monitored to detect focal avian species.

Photo points will be used to document general changes in habitat conditions within sampling areas. Photos will be taken in the 4 cardinal directions. Photo points provide historical perspective and provide a shareable perception of habitat condition for a broad constituency (i.e., biologists, administrators, public).

Vegetation sampling will be conducted annually along randomly placed transects through each plot. Basal area of trees and snags, and ground cover vegetation will be categorized as grasses, forbs, shrubs, saw palmetto and bare ground. Additionally vegetation measurements will be collected on approximately 20 smaller (0.1 acre) plots outside of the CFLR Primary Enhancement areas to provide additional information related to the
response of the vegetation to fire treatments alone. The potential locations of these smaller monitoring plots are shown in Figure 19.

This monitoring data will be presented by TTRSLC at annual interdisciplinary collaborative planning meetings to adapt management strategies and will provide critical data to annually update the ECM and management prioritization models. By the end of the CFLR project, the information gathered through this monitoring endeavor will refine the ECM for the next 5-10 years setting the stage for the next decade of management.

**Frosted Flatwoods Salamander Monitoring**
The ONF has an existing Challenge Cost-Share agreement with The Nature Conservancy’s Northeast Florida Prescribed Fire Strike Team. This agreement would be expanded to monitor the effects of CFLR activities within the species' designated Critical Habitat and the FFS Conservation Area.

**Technology Transfer of Monitoring Results**
In addition to annual interdisciplinary collaborative planning meetings with stakeholders, the ONF will work with the Florida Forestry Association, Florida Division of Forestry, Georgia Forestry Commission, The Longleaf Alliance and America’s Longleaf to facilitate the transfer of valuable information through the 10-year monitoring effort. The impact of different management actions as well as the order, extent and frequency of these actions will improve the knowledge base for land managers in the southeast coastal plain.
Figure 19. Potential locations for 200 acre Vegetation-Avian Community Response plots and 0.1 acre vegetation only plots.
5. References Cited


